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Port Royal Harbor - A Seafood Industrial Complex

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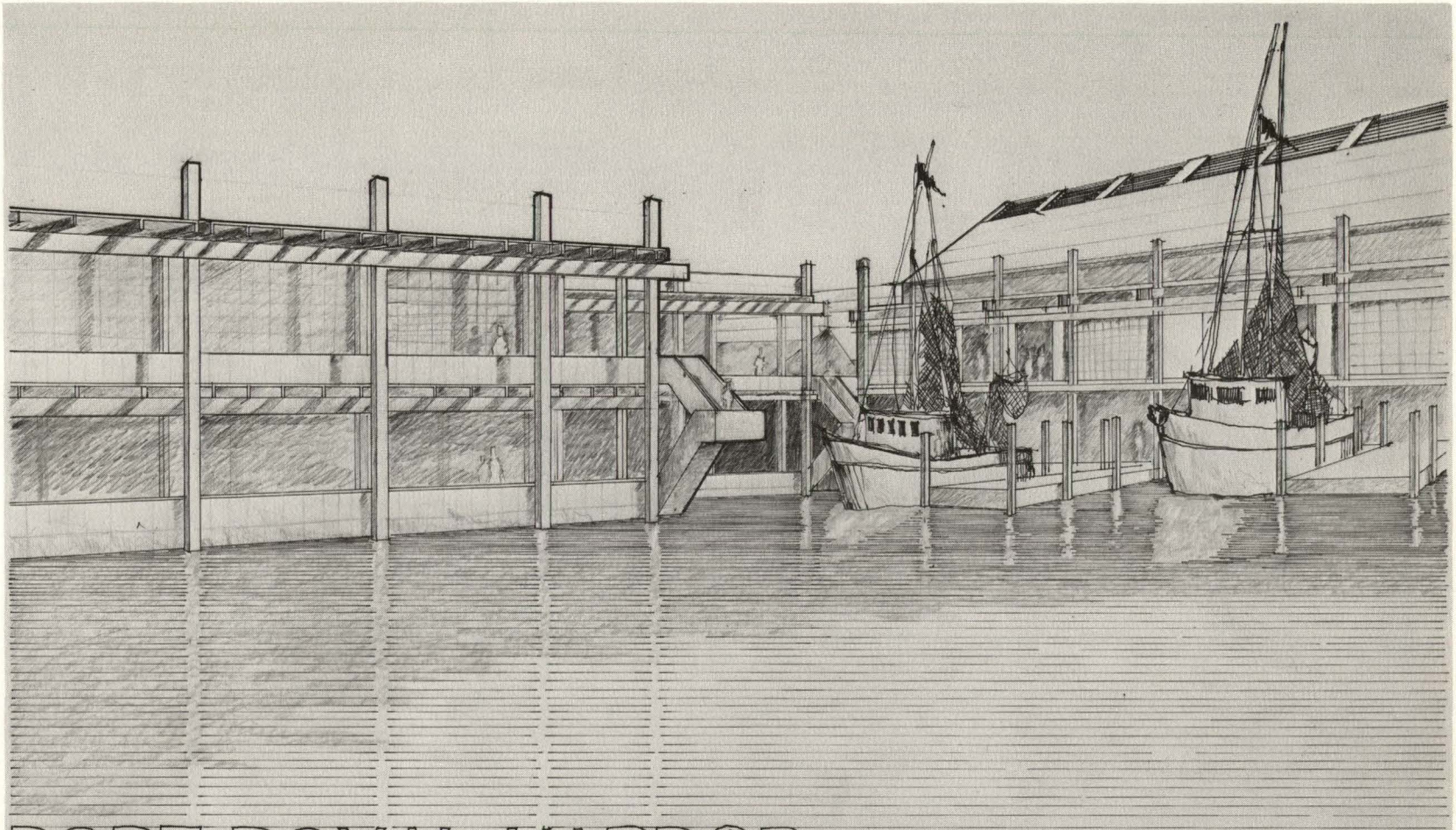

PORT ROYAL HARBOR

A SEAFOOD INDUSTRIAL COMPLEX

A TERMINAL PROJECT SUBMITTED TO THE FACULTY OF THE COLLEGE OF ARCHITECTURE , CLEMSON UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE, MASTER OF ARCHITECTURE.

19 APRIL 1983

John T. Clayton III

PORT ROYAL HARBOR
A SEAFOOD INDUSTRIAL COMPLEX

A terminal project submitted to the Faculty of the College of Architecture, Clemson University, in partial fulfillment of the requirements for the degree, Master of Architecture.

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This manuscript is dedicated to my family, for without them none of it would have been possible or meaningful.

I would like to thank the following:

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and most especially my classmates, for their friendship, encouragement, patience, and fortitude in putting up with me.

Thanks,

Clay

Table of Contents

Problem Statement 1

Seafood Parks 5
Background 6
Coastal Plains 9

Setting 14
East Coast 15
South Carolina 16
Beaufort County 17

Site 18
Context 19
Description 20
Analysis 21
Conclusions 26

Activities 27
Users 28
Processes 34
Handling Arrangements 42
Zones 47

Program 53

Case Studies 61
Recovery New Orleans 62
Wanchese Seafood Industrial Park 63
Sea Harvest Industrial Park 64

Criteria 65

Works cited 71

Bibliography 73

Proposal 76

Due to a printing error, I regret that it was necessary to use photocopied divider sheets, please see other copy of this manuscript for a more accurate idea of the final product.

John T. Clayton, III "Clay"

PROBLEM STATEMENT

Commercial fisheries have a unique economic status in the Nation. Because of their renewable nature, they can benefit man indefinitely when they are wisely managed. However, to reach their full potential several current objectives must be achieved, the most important among these is the need to reduce the cost of harvesting, processing, and distribution. In South Carolina, the fishing industry is characterized by small family operated businesses which have not been able to take advantage of contemporary technology used by larger operations in the seafood industry. As a result, there has been little advancement in cost-saving technology in the state.

Centralization of support facilities for the fisherman could easily reduce his harvesting costs. In addition, the processing industry is faced with large cash outlays for the purchase of pollution control equipment and meeting current

Environmental Protection Agency requirements may cost as much as a third of initial plant investment.[1] By combining these pollution control and waste handling facilities, the processor can realize a large savings. At the present time, over 60% of the seafood consumed in South Carolina is shipped in from other states, while most locally harvested seafood is processed out of the state. This results in excessive cross-handling, where South Carolina seafood is shipped out of state while substantial quantities are brought in from other states for local consumption.[2] The possibility of instate processing and distribution would mean a real savings to the consumer and the distributor.

In response to these possibilities, the following is a proposal for a Seafood Industrial Park to be named "Port Royal Harbor: A Seafood Industrial Complex." The concept would provide a flow of seafood products through the various levels of harvesting,

processing, and distribution, providing for the common needs of the harvesters, dealers, and processors. While the processing requirements will provide the major architectural components, the support facilities for harvesting and distribution will also play a major role in the design of the complex.

The following section will discuss the history of Seafood Industrial Parks in general and the Port Royal facility in particular.

SEAFOOD PARKS

Background

Since his beginnings, man has fished the seas for nourishment. As he learned it was much easier to use a net rather than his hands or a spear, he also soon realized that the catch was better out in the ocean than in the surf. This necessitated the building of boats and sequentially the development of harbors. Soon protected harbors became ports for the fishing fleets of new coastal cities. Fishing fleets originally served only a local market but the need for expanded markets brought about new technologies which allowed for the processing of seafood so that it could be distributed to those located away from the coastal areas.

While the concept of the Seafood Industrial Park is relatively new, the first recorded public docks in the United States were at Aransas Pass, Texas in 1940. This facility only provided common facilities for the fisherman and did not address the dealers

or processors, consequentially processing and distribution techniques were not improved.

The Port of Brownsville was the next major harbor to recognize the need for common facilities for the Seafood Industry. In 1946, the director had asked the United States Corps of Engineers to consider dredging a small-boat harbor independent of their ship channel and harbor. Finally in 1950, Congress approved and funded the project, but the Korean Conflict caused funding for the project to be delayed.

In 1952, the Port Authority announced it would fund the project without the government's aid. In 1953, the dredging was completed, and the nation's first seafood port with common docking facilities as well as dealer and processing facilities opened. Brownsville is primarily a shrimp facility, and it wasn't until 1974 that the idea for a facility to handle many different types of species was

conceived as appropriate for the coastal areas of South Carolina and the other southeastern states.

Coastal Plains

In 1974, the Coastal Plains Regional Commission created a Seafood Ad-Hoc Committee to formulate specific recommendations for the development of the Industry. This committee was composed of members representing North Carolina, South Carolina, and Georgia. Through meetings with seafood experts and visits to similar facilities across the nation the committee recommended that each state look into the feasibility of a seafood industrial park for improving the economic health of the Seafood industry in the state.

The Coastal Plains Commission approved $60,000 for preliminary feasibility studies and, if the state desired, an additional $100,000 was made available for initial design studies.

After the initial feasibility study was completed in South Carolina by the South Carolina Wildlife and

Marine Resources Department, the Coastal Plains Regional Commission awarded a grant to the same department to study three recommendations with a logical set of objectives.

These three recommendations based on the findings of the feasibility study were:

1. That an intensive information and education program be undertaken to improve the general understanding of the seafood industrial park concept.
2. That a fishery resource assessment be conducted offshore to determine the potential for an expanded fishery base necessary to support a large seafood port.
3. That the Coastal Plains Regional Commission proceed with the preliminary engineering and design work needed to complete a comprehensive document for planning and developmemt.

The Wildlife and Marine Resources Department

attacked the first and primary recommendation by forming the Beaufort County Seafood Industrial Park Ad-Hoc Committee in 1976 to study the concept of the park and hopefully educate those not open to the idea. After meeting and visiting other facilities including Brownsville, a public meeting was held in 1977 where the pros and cons of the concept were discussed. At this meeting, representatives of the industry voted unanimously for the department to proceed with the preliminary engineering and design work. After receiving this approval, the department contracted an outside firm to provide the requested engineering work.

In December 1977, the Beaufort County Council agreed that from that point, the county would be the lead agency in the development of the Port Royal seafood industrial complex. Sometime after this, the primary state agency involved in the project ceased to be the Wildlife and Marine

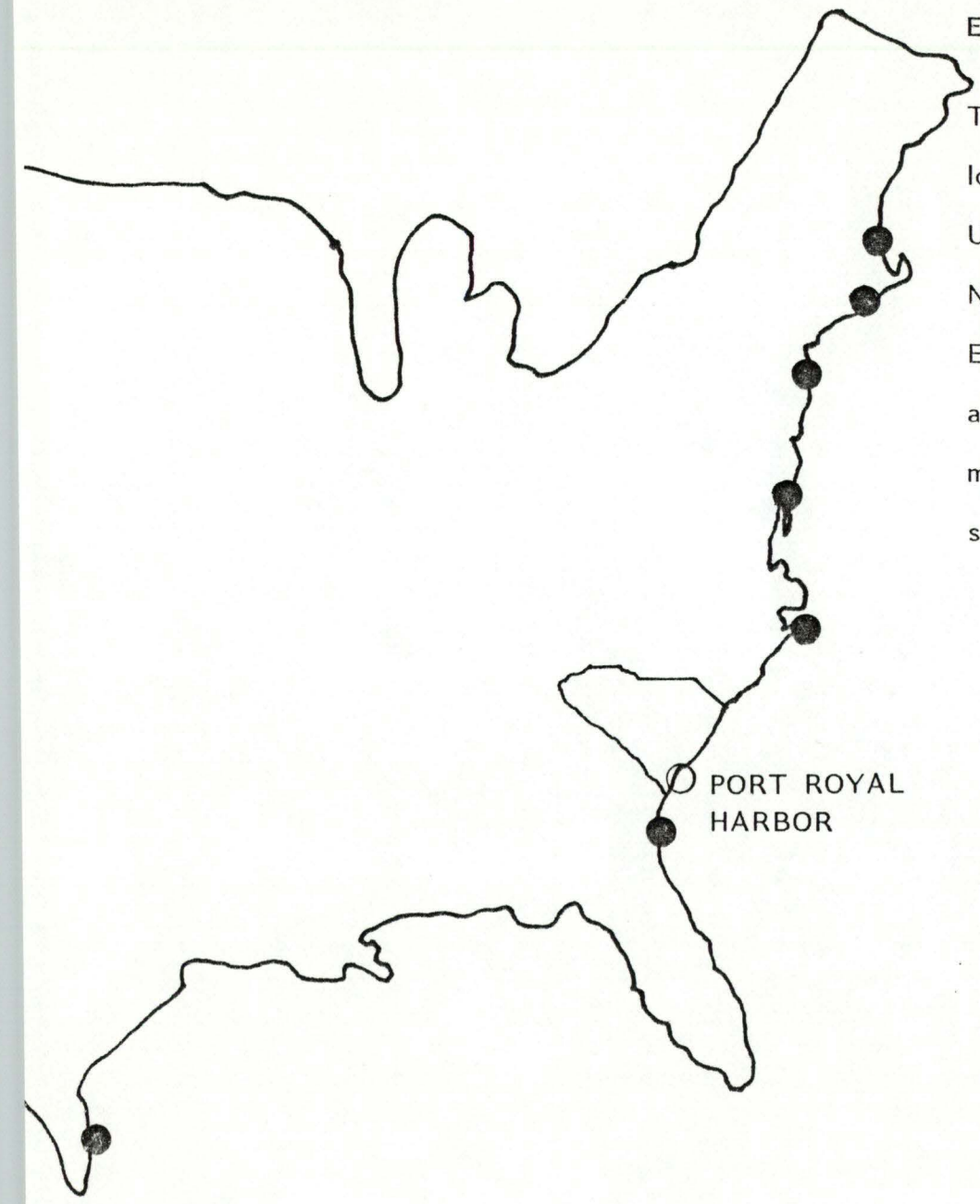
Resources Department and the South Carolina State Ports Authority assumed primary jurisdiction. In the time period between their assuming responsibility for the project and the present, little has been done to further the realization of the park. The Ports Authority commissioned a study by a consortium of planning and architecture firms which closely paralleled the work already done under the Wildlife and Marine Resources Department. However, with this exception, little advancement in the development of the idea has occured since 1977.

Due to the current economic conditions in the country, major federal funding for this project and similar ones in Georgia is not available. Studies were already underway in North Carolina when the Coastal Plains Regional Commission recommended them to South Carolina and Georgia. These studies in North Carolina resulted in the construction of the public facilities at their Seafood Park at Wancheese. Unfortunately, due to a silting problem

at the inlet to the Ocean the park has not been successful. Therefore, a complete architectural study of the concept has never been completed.

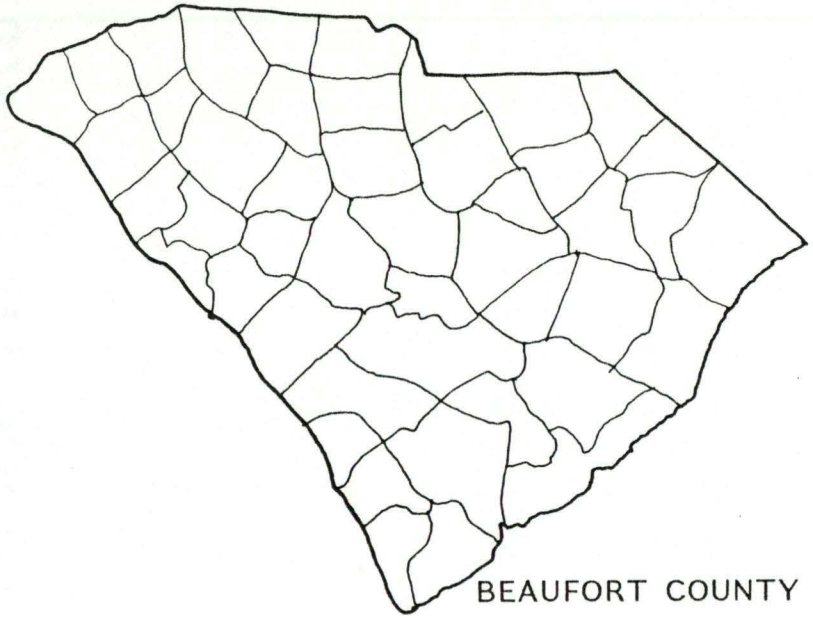
The next section will discuss the setting of the proposed facility.

SETTING



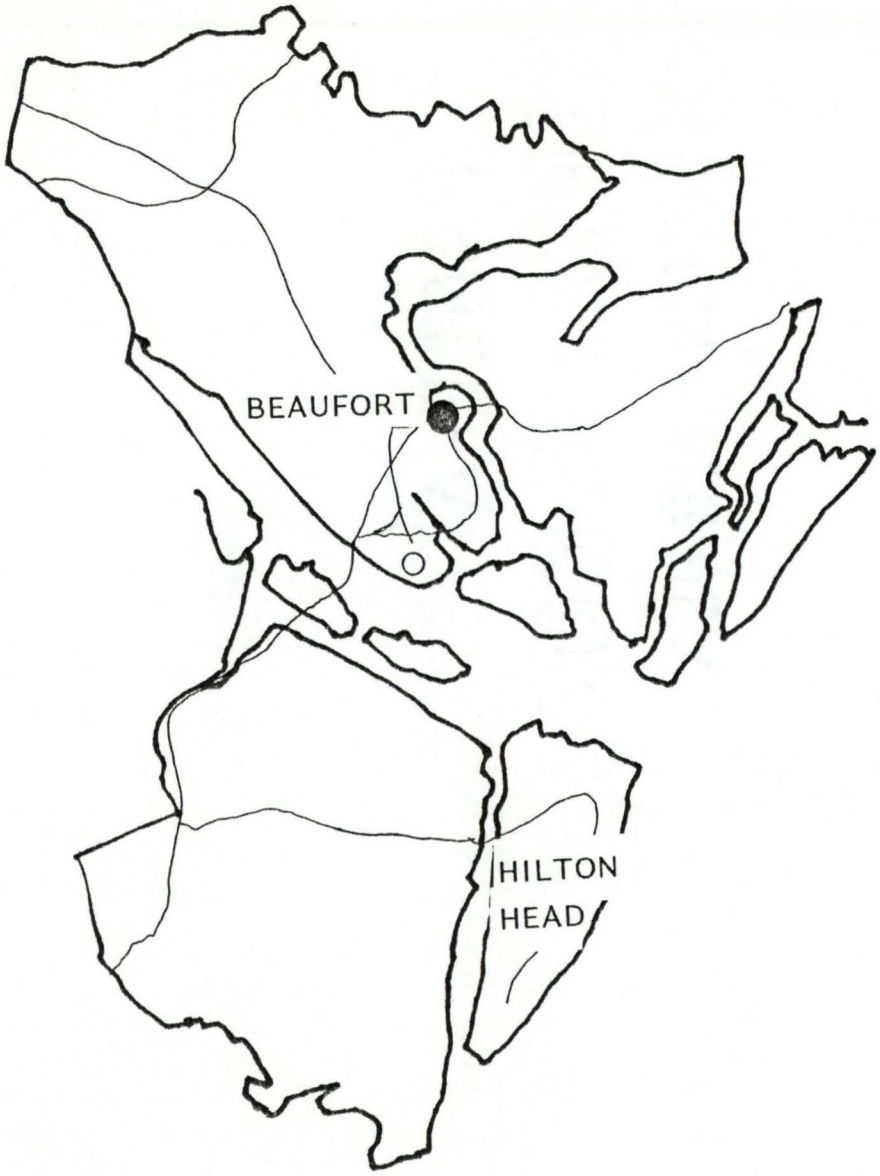
East Coast

There are several Seafood Industrial Complexes located on or planned for the Atlantic Coast of the United States. With a few exceptions in the Northeast, most are not operational at this time. Each serves those fishermen located in its vicinity as well as an occasional ocean-going trawler which may put to sea and not call at its home port for several months.



South Carolina

Major South Carolina fisheries are located at Little River, (near Myrtle Beach); Murrell's Inlet, Georgetown, Shem Creek, (Charleston); and Beaufort/Port Royal. Each of these has users who harvest the sea in their vicinity with few ocean-going trawlers calling at the existing facilities.



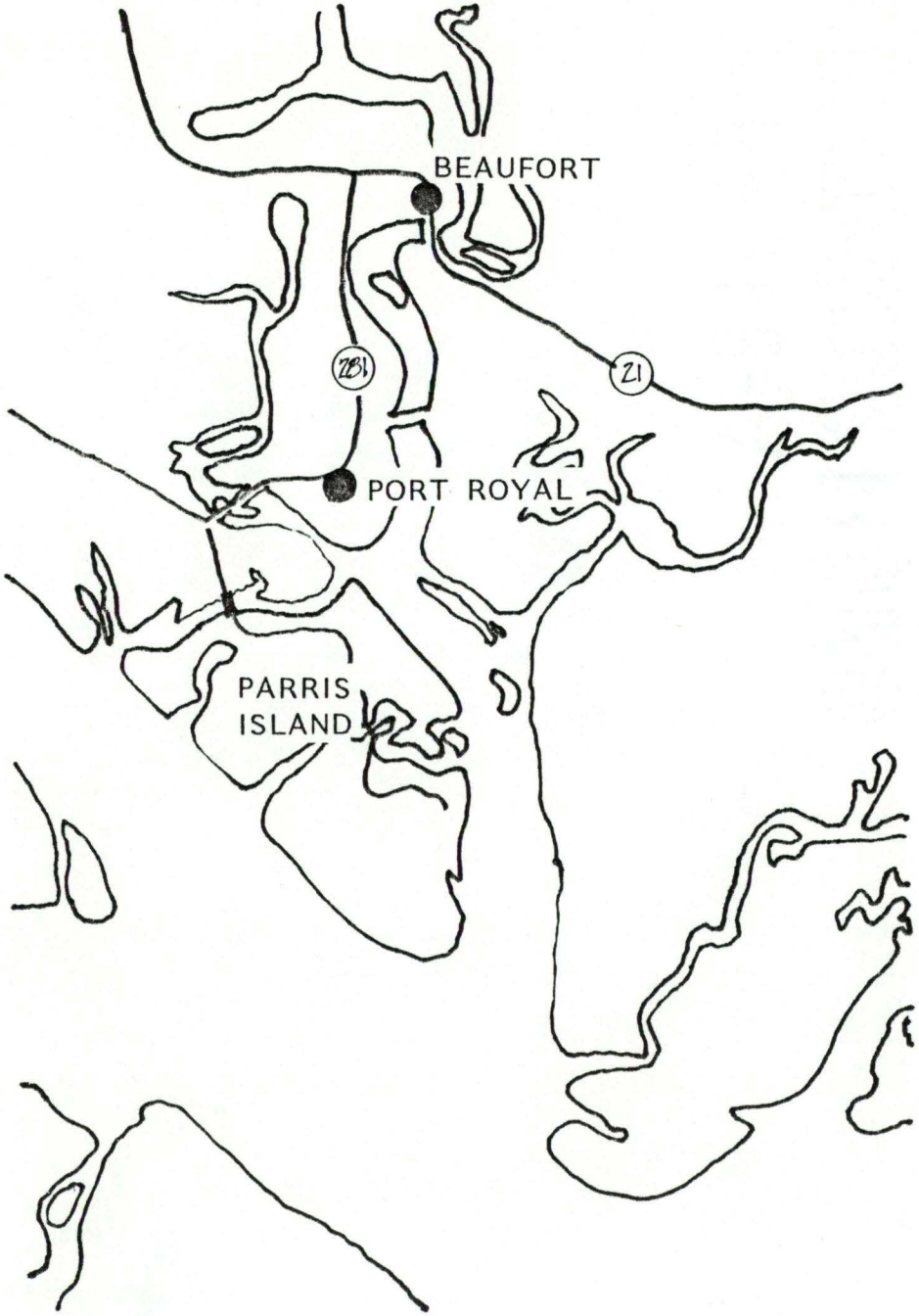
Beaufort County

Beaufort County is the southernmost county in South Carolina and next to Charleston has the greatest number of tourists each year. With Hilton Head and Beaufort serving as major attractions. The resident population of the county is 57,800 persons, a 13% increase from the 1970 census.[3] There is a comparatively large labor force capable of staffing the proposed Seafood Industrial Complex.

The next section will discuss the site in terms of its context, as well as a description, analysis, and conclusions in terms of use, movement, and perception.

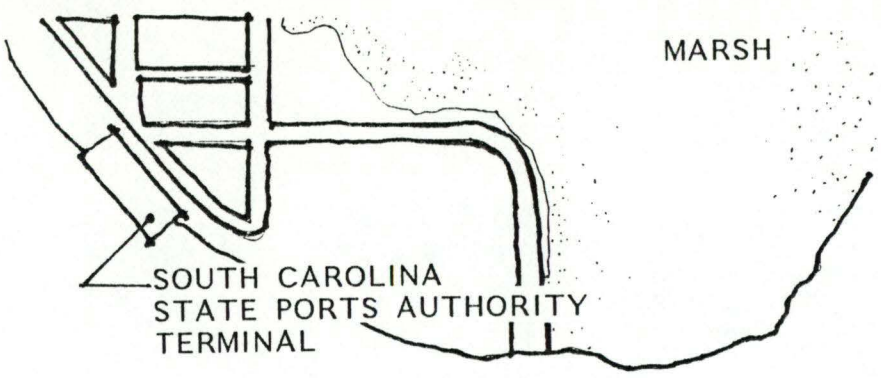
SITE

Context



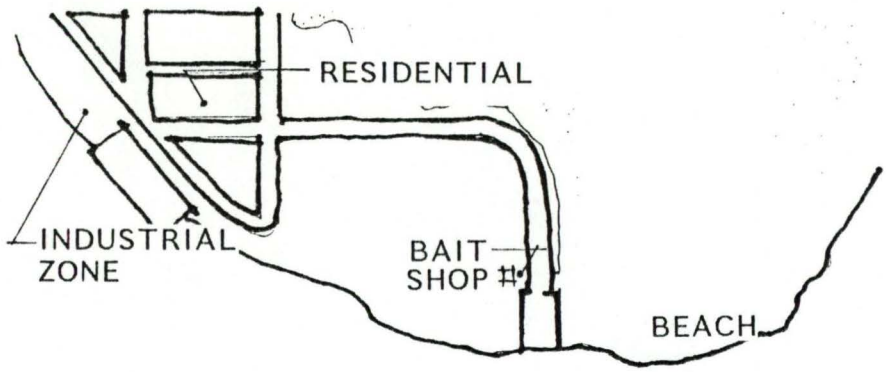
Port Royal is a town of 15,735 persons located 3 miles south of Beaufort and approximately 40 miles north of Hilton Head.[4] The area is primarily residential, serving as a "bedroom community" for both Beaufort and the Marine base on Parris Island which is located just across Battery Creek. Several small seafood processors are currently located near the creek, as well as the South Carolina State Ports Authority terminal which is currently leased to Port Royal Clay Company.

Description



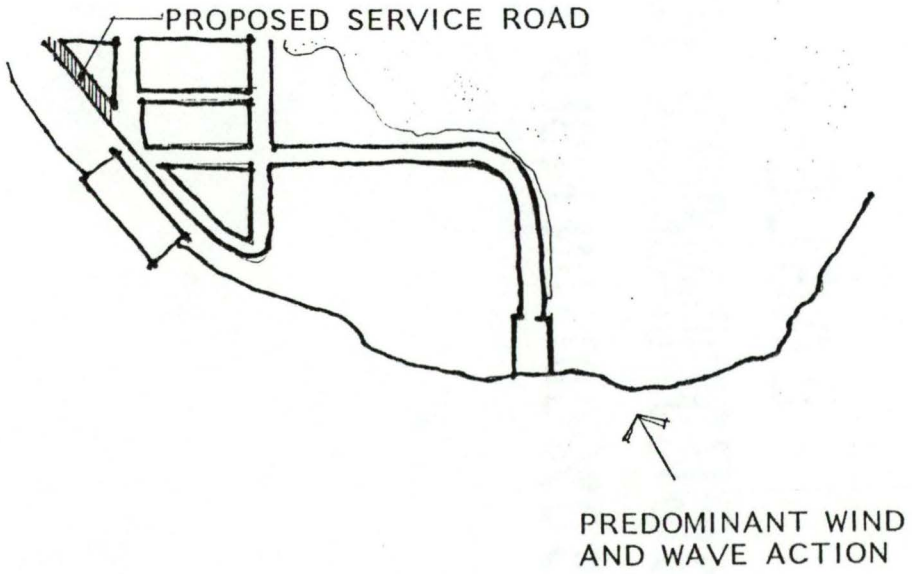
The site is a low-lying marshy area adjacent to the South Carolina State Ports Authority terminal and between the Beaufort River and Battery Creek. The majority of the site is currently owned by the South Carolina State Ports Authority. The site has an average elevation of 3 feet above mean sea level.

Analysis



Use

Currently, the only use of the site is for recreational purposes. There is a small bait shop located adjacent to a public boat landing and a public beach located on the point of the peninsula. Both industrial and residential areas are adjacent to the site.



Movement

A major reason for selecting this particular site was its central location and proximity to the major roads in the region. However, the routing of traffic along Parris Avenue requires further study. The Port Royal Development Plan Update, prepared by the Beaufort County Joint Planning Commission, recommends that a road be constructed parallel to the rail spur. This plan should be evaluated but seems to carry merit, as the Port Royal Clay Company who are currently leasing the State Ports

Authority terminal, average 600 transport containers a month. This heavy traffic, combined with that produced by the Seafood facility, seems to argue for the construction of this road, thereby relieving the main street of Port Royal of this traffic. Movement on site is currently on dirt roads, except for the area of the boat landing.

The distribution of services to the site and removal of wastes will for the most part use existing systems. Currently Port Royal purchases its water from the Beaufort-Jasper Water Authority. No problems are anticipated in obtaining the necessary quantity for the complex. However, it will be necessary to provide an additional water line from 14th Street to the site.

The complex will become a part of the Port Royal waste treatment system. Currently, Port Royal contracts the City of Beaufort to handle its waste treatment needs. Therefore, it will be necessary to

meet their requirements when developing pre-treatment facilities on the site. Facilities are currently being constructed to make the Port Royal system usable by the complex. These include a pump station located on the eastern side of the intersection of 7th Street and London Avenue. This station will be the reception point for wastewater produced by the facility. Also, it will be necessary to supplement the main from this station with a parallel line, or replace it with a large main.

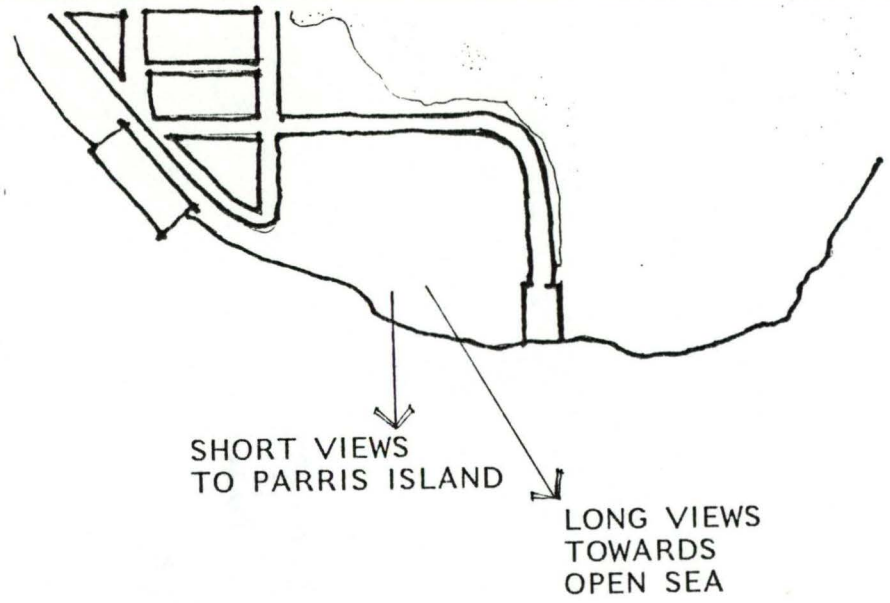
This table shows minimum requirements for introduction of wastes into the Beaufort waste disposal system.

Parameter	Acceptable Limit
B.O.D. (assumed 5 day)	250mg/1 max.
Suspended solids	250mg/1 max.
Fats, Oil, Grease	100mg/1 max.
pH	6.0-8.5
Temperature	160'F max.
Toxic substances	0.00

Flow equalization may be required where flow is greater than 5000 gallons per day.[5] These requirements will be met through the construction of a small pre-treatment facility.

Perception

One's initial perception of the site upon entering Parris Avenue is of the State Ports Authority terminal. Once on site, one becomes aware of short range views across the river to Parris Island and the Marine Base located there, as well as longer views past the island out towards the open sea.



Conclusions

Current use of the site does not seem to stand in the way of development of the complex. However, it will be necessary to provide for or protect the recreational areas currently existing on site. An effort needs to be made when designing the park to avoid conflicts between its traffic and that of the Ports Authority terminal. This would most easily be handled through the proper design of the proposed service road linking the site to Highway 281. The views to Parris Island and towards the open sea need to be considered when locating the public related activities of the complex.

The next section will deal with the activities taking place at the facility. These will be discussed in terms of users, processes and zones.

ACTIVITIES

Users

There are five basic users of the Seafood Industrial Complex. These are the administration, the fishermen, the dealers, the processors, and the public. Each relates to a particular area of the complex yet these areas often overlap.

The Administration

For the most part, the Seafood Industrial Park is operated by a state agency. This agency is in charge of the construction of common facilities as well as the management of the park. The common facilities which are usually owned and operated by the agency are unloading and berthing docks and waste treatment facilities. All other portions of the park are usually leased areas or concessions. These include repair yards, restaurants, processing plants, etc. Each of these would be built and

maintained by the owners under the supervision of the agency. Some parks, especially in the Northeast, are owned by private corporations. In South Carolina, it has been assumed that the park will be operated by a department of the Ports Authority and parcels will be leased to various processors and concessionaires after the common facilities are completed.

The Fisherman

Currently the majority of fishermen in the Port Royal area are shrimpers, with the next largest group being crabbers. At the present no fishermen harvest finfish, except for what might accidentally be caught when searching for other species. It will be necessary for some of the current fishermen to begin harvesting finfish as their primary catch. It is felt that a number of the present fishermen will change to harvesting finfish when the necessary processing facilities are available and a market exists for these products. The fishermen will also rely upon the seafood industrial complex for berthing, fueling, and repair services. The complex will concentrate these services in one location rather than at many separate places as is current practice.

The Dealer

The dealer is the primary wholesaler of seafood products in South Carolina. Currently he purchases the catch from the fisherman and provides him with fueling and icing facilities. He then resells the catch to processors and secondary wholesalers; these secondary wholesalers include the large retail grocery chains and in some cases, restaurants. The complex will provide him with office and storage space, as well as relieving him of the responsibility of providing boat service.

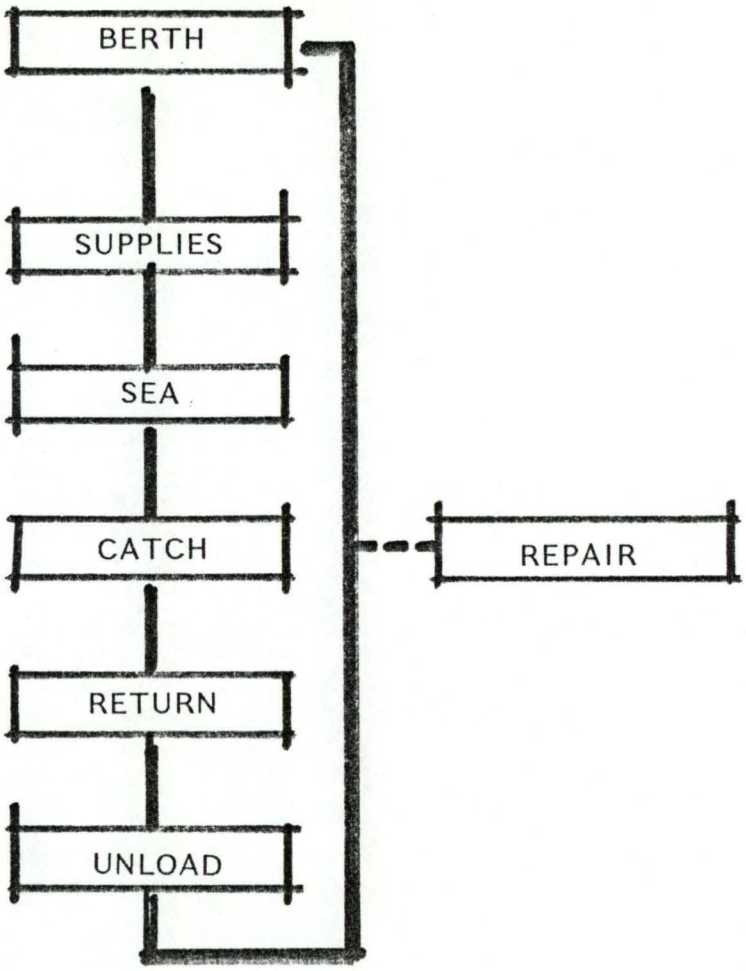
The Processor

The processor currently purchases his products, consisting of shellfish or finfish from the dealer. He then is in charge of any processing which must take place; these might include packaging, freezing, or more complete processing procedures which will turn the product into an oven-ready food source. In addition to fulfilling spacial needs, the complex will provide the processor with needed utilities and waste treatment facilities.

The Public:

The public will be attracted to the seafood industrial complex by a first class restaurant as well as a fresh seafood market. In addition, tourists will be encouraged to visit the facility on their way from Charleston to Hilton Head or Savannah. It is assumed that the boating public will also take advantage of the fueling and icing facilities as well as the repair yard which will also serve the yachts using the Inter-coastal Waterway.

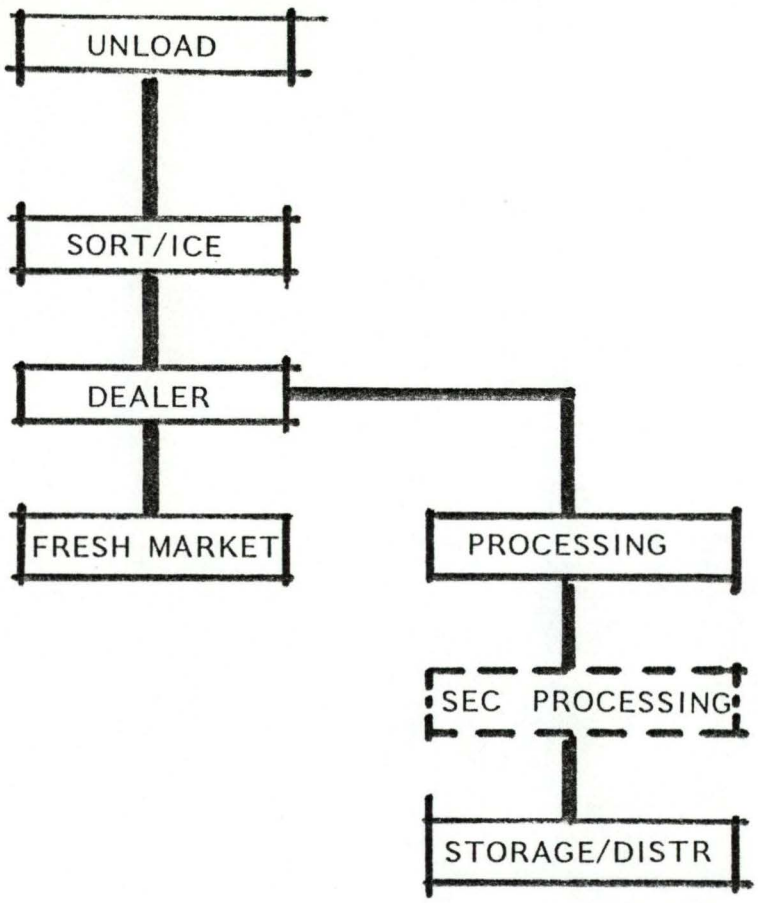
Processes



There are two basic flow patterns which take place within the complex. The first is that of the seafood as it is brought in as a raw resource by the fisherman and the second is the seafood as it is converted from a raw resource to a processed product.

The fishing vessels are berthed at the waterfront near the service dock. Before going out to fish they are taken to the dock where they are fueled, and ice and water is onloaded. Upon returning from the sea, the fisherman docks at an unloading berth where the catch is offloaded and moved into the Handling Hall. At this point the fisherman's contact with the process is finished and he returns his boat to its berth.

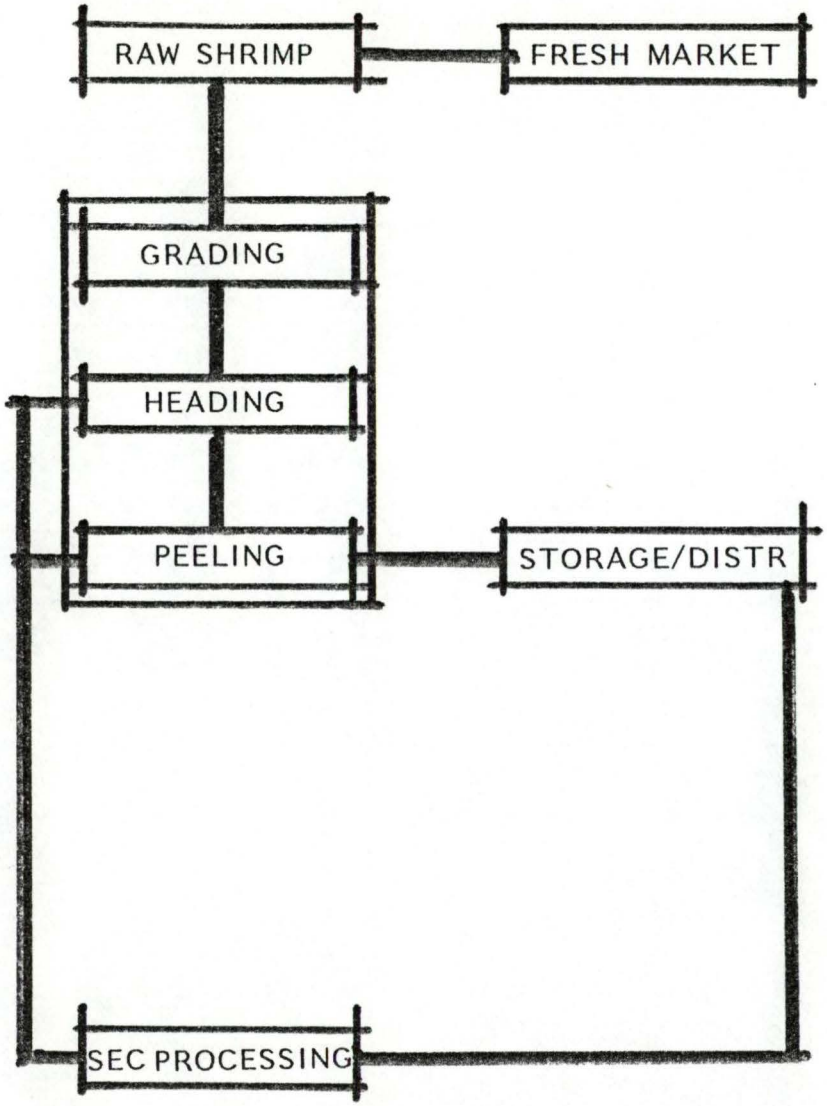
Once the catch is offloaded, the dealer or processor who has purchased it assumes responsibility for the



product. In most cases, those products bought by the dealer are simply iced and sent to a fresh market. If the seafood has been purchased by a processor, it is routed to his processing facility where it is converted into a canned or packaged product. It is then transported to a central distribution and storage facility or to other facilities for secondary processing.

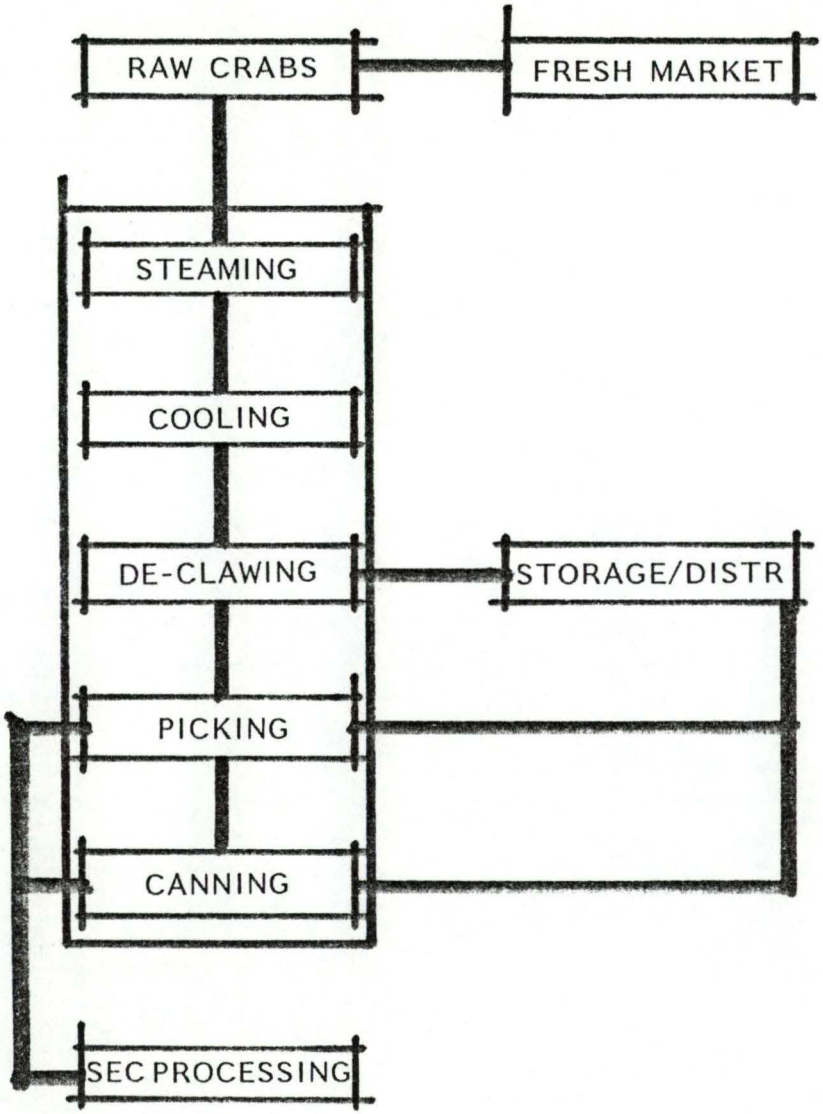
Each species of seafood has a different processing method and even within the species, the process varies, depending on the final product desired. The seafood industrial complex, will in its beginning stages, be primarily concerned with four species of seafood: shrimp, crab, oysters, and finfish. If it becomes more profitable to market non-traditional seafood species such as eel in the future, it is possible that new processing facilities will be added.

Shrimp Process



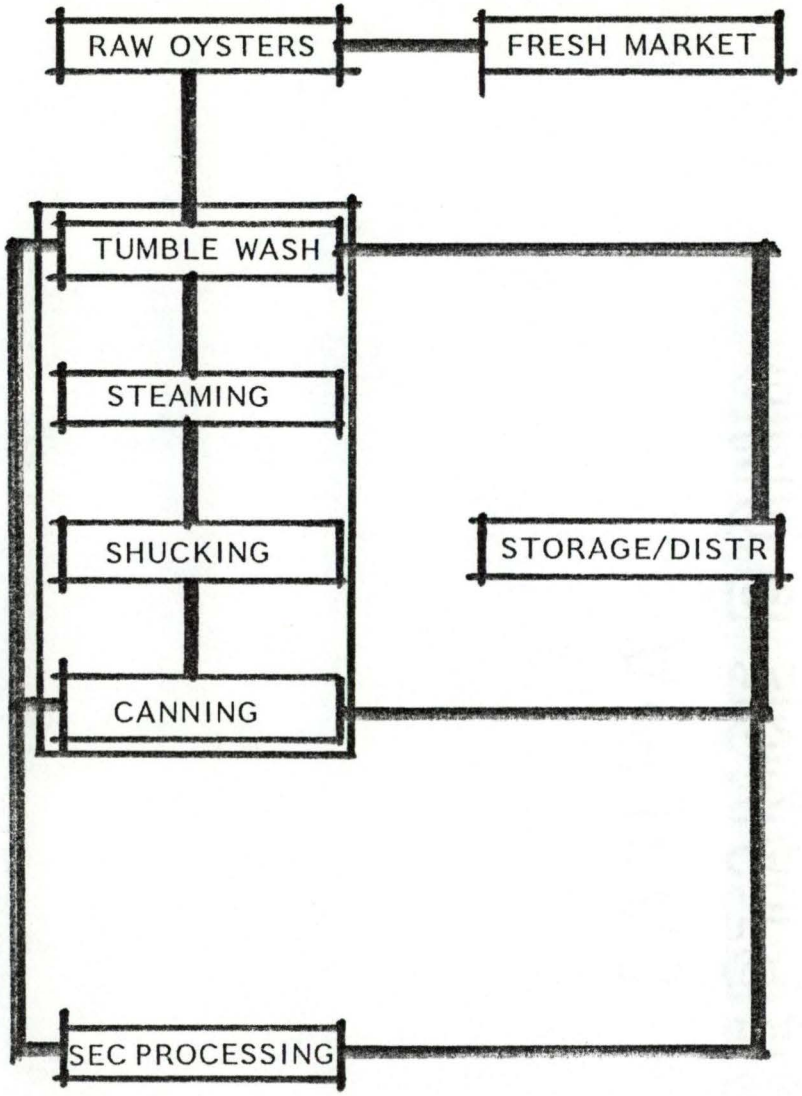
Shrimp is South Carolina's primary fishery with annual landings averaging almost 2.6 million pounds per year.[6] As can be seen from the chart, the product can be marketed at a number of points in the process. The average consumer of fresh shrimp purchases it after it has been headed, but before peeling and de-veining take place. With regards to the chart at left, "recipe" refers to any of a multitude of processes, these include, but are not limited to battering, preparation for shrimp cocktails, and shrimp portions.

Crab Process

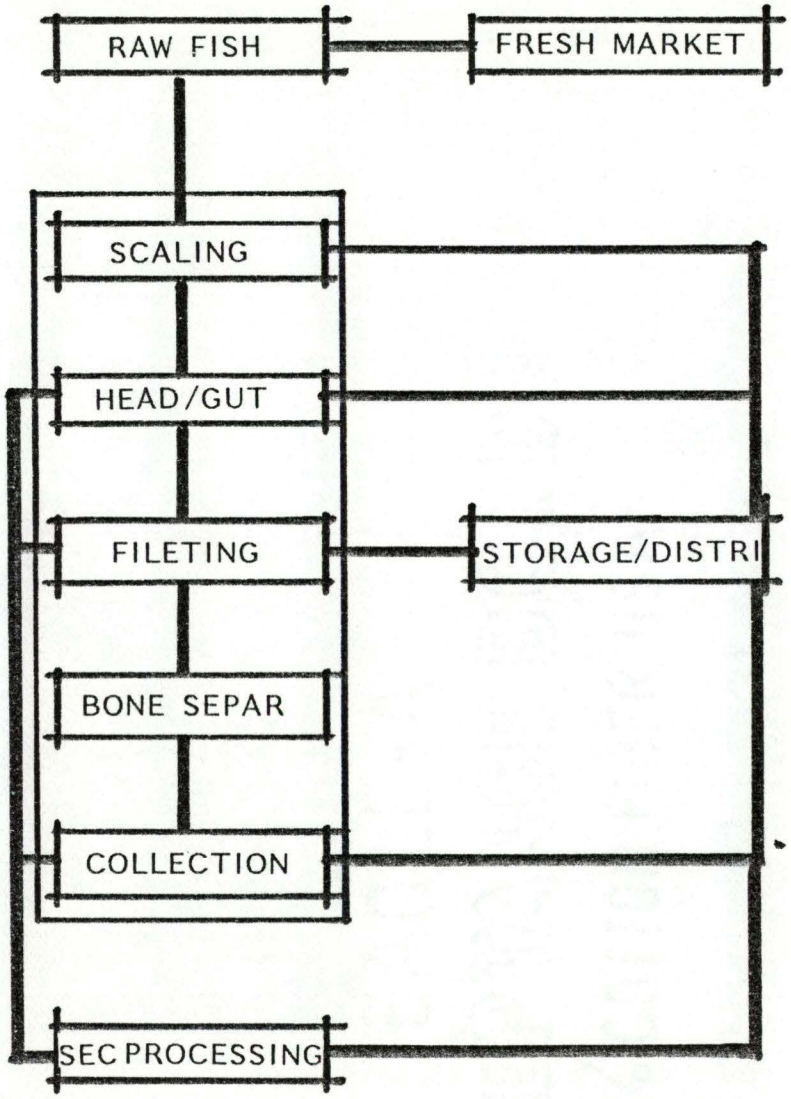


The blue crab fishery is the second most important in Beaufort County.[7] Although production is higher in volume than shrimp, value at the dockside is less. Like the shrimp process, the crab process is done primarily by hand rather than by machines. However, there are several patents held for mechanized crab picking, even though they are not currently used in South Carolina.

Oyster Process



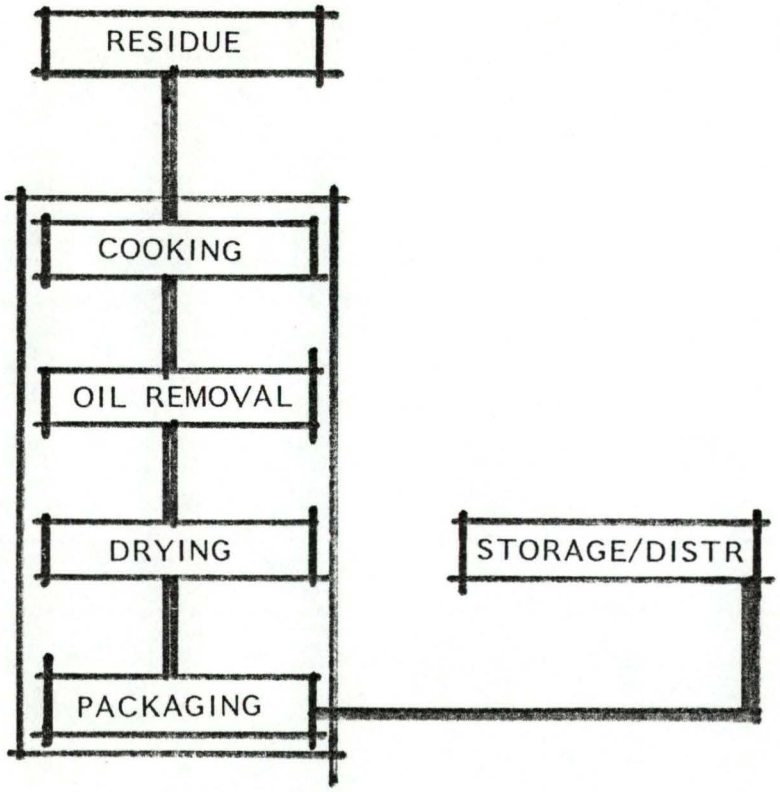
The oyster fishery ranks third in Beaufort County with annual landings over the 1972-75 period averaging less than a million pounds and even less in terms of dockside dollars.[8] There are two types of oysters processed; singles and clusters The former are the more desirable and also the more expensive. These are the oysters usually found on buffets and in cocktail bars. Cluster oysters are used to provide shucked oysters for canning purposes. These are also the oysters most often used for Oyster roasts principally because of their lower price. The processing for the singles is done primarily by hand while machines are used to process clusters.



Finfish Process

Finfish landings consisting of five species in this area, represent only a small portion of the commercial catch in Beaufort County.[9] In most cases, this catch is the result of finfish caught while searching for other species such as shrimp. It is hoped however, that the introduction of processing facilities will cause a demand for finfish which will be met by increased interest by fishermen in the area.

Reduction Process



During each of the preceding processes, all the waste products are removed to a central processing facility where they are transformed into fish meal. Fish meal is a high protein by-product of seafood processing that is used both as a food supplement in underdeveloped countries, as well as products such as tropical fish food and farm fertilizers in this country.

Handling Arrangements

There are basically three different handling arrangements available to a Seafood Industrial Complex. The first two are based on the use of a traditional market arrangement. This is one in which the fishermen make individual sales of their catch either to dealers or directly to processors, usually by pre-arrangement. In short, before the fisherman ever leaves port he knows to whom he will sell his catch.

Handling Alternative 1

A traditional market arrangement with fragmented physical layout. The facility supplies common services *such* as berthing and fueling, while each dealer would have his own unloading berths and handling facilities. This alternative is acceptable to dealers and processors as it is exactly like the current arrangements except that they are no longer responsible for servicing the boats. This alternative would be the most expensive for the facility as each dealer and processor must be provided with dockside land and berths. In addition, future development of the facility is limited by available land and not by the market.

Handling Alternative 2

A traditional market arrangement with integration of dock facilities for communal use. This arrangement provides central dockside fish handling for all the dealers and processors. This allows the dealer and processing facilities to be located on inland land and not at the valuable waterfront. There is some resistance to this arrangement from dealers and processors due to unfamiliarity with communal use facilities as well as a reluctance to commit to sharing facilities with competitors. With this arrangement, expansion is geared to market conditions and not to available waterfront land.

Handling Alternative 3

A market auction with integrated physical configuration. In this alternative, the fish handling does not involve fishermen, dealers, or processors; rather a labor force unloads and boxes the harvest prior to the day's auction. The catch is auctioned to the dealers and processors after the fleet returns for the day. The products are then routed to the appropriate dealer or processor. This system should result in better quality and larger catches. Also, the price would be determined by supply, demand, and quality rather than by prices set in New York and Florida where quality has little effect on the price. Currently, there is high resistance to this alternative presumably due to unfamiliarity with the system.

Handling Alternative 2 will be pursued in this study as it offers the most opportunities for academic research as well as seeming to be the most acceptable to both management and the user. It is hoped that Handling Alternative 3 will eventually be used, and therefore the project will be designed with this in mind.

Zones

For study purposes, the activities have been broken up into various zones. Each zone will be described by the physical entities found there as well as by a general location.

Handling Zone

Unloading Berths	The dock space where the boat is unloaded
Handling Hall	Facility for the sorting and initial icing of the catch
Dealers offices	Office space for the buyers
Ice plant	Facility for the production of ice for the initial unloading of seafood
Location	at waterfront

Processing Zone	
Processing Plants	One for each process
Storage/Distribution	A central freezing and storage center
Location	related to Handling Hall

Visitor/Admin. Zone

Admin. offices	Offices for the management of the complex
Restaurant	A first class dining room and lounge
Seafood Market	A public market
User Facilities	These would include a canteen, beer bar, and lounges
Location	at waterfront

Berthing Zone	
Overnight mooring	Pier for the trawlers
Service Dock	Pier for fuel, water, and ice
Location	at waterfront

Ship Repair & Service Zone

Major repairs	Pier space for tying up the vessels
Repair yard	Outdoor space away from other areas
Dry docking	An inlet to allow for removing vessels from the water for repair
Net repair	Indoor and outdoor space for repair
Electronic repair	Indoor space for repair of radar, radios
Chandler	Commercial space for marine goods
Grocery	Commercial space for foodstuffs
Location	Near berthing

Complex Service Zone	
Wastewater treatment	Pre-treatment facility to prepare wastes for introduction into existing Port Royal System
Fuel storage	Underground tanks to store fuel for use by the service pier
Maintenance area	Storage of tools and equipment
Location	related to existing utilities.[10]

The following section will provide the space program for the various areas of the Seafood Industrial Complex.

PROGRAM

The studies done by both the South Carolina Wildlife and Marine Resources Department and the private firm hired by them suggests that the project be built in three phases. The first phase will provide the facilities needed for the existing fleet at Port Royal. Phase 2 will allow the expansion of the facility to handle processing for all five types of products rather than just the four species currently harvested. In addition, the number of berths for vessels will increase to 90. Phase 3 will provide room for 150 vessels and will add the reduction process of turning waste products into fishmeal.

Handling/Processing Zone

Space	Square footage Phase 1	Phase 2	Phase 3
Unloading Berths	6	6	10
Handling Hall	24000	24000	40000
Dealers offices	1200	1200	2100
Ice plant	300	300	300
Storage/Distribution	10000	15000	20000
Parking	28 cars	28 cars	47 cars

Processing Zone

Space	Square footage Phase 1	Phase 2	Phase 3
Processing plants			
Crab Processing	7000	14000	14000
Shrimp processing	7000	7000	14000
Oyster processing	7000	14000	14000
Finfish processing	2100	2100	4200
Reduction processing	1800	1800	1800
Parking	48 cars	128 cars	136 cars

Visitor/Admin. Zone

Space	Square footage Phase 1	Phase 2	Phase 3
Admin. offices	1000	1000	1000
Restaurant	4300	4300	4300
Seafood Market	500	500	500
User Facilities	2300	2300	2300
Parking	110 cars	110 cars	110 cars

Berthing Zone

	Phase 1	Phase 2	Phase 3
Overnight mooring (number of ships)	40	90	150
Average length	52'	60'	65'
Length range	25-80'	25-100'	25-100'
Service Dock	200'	200'	200'
Parking	80 cars	162 cars	300 cars

Repair/Service Zone

Space	Square footage		
	Phase 1	Phase 2	Phase 3
Major repairs	1200	1200	1200
Repair yard	37000	37000	37000
Dry docking	40x80	40x80	40x80
Net repair	1000	1000	1000
Electronic repair	1000	1000	1000
Chandler	1600	1600	1600
Grocery	1000	1000	1000
Parking	37 cars	37 cars	37 cars

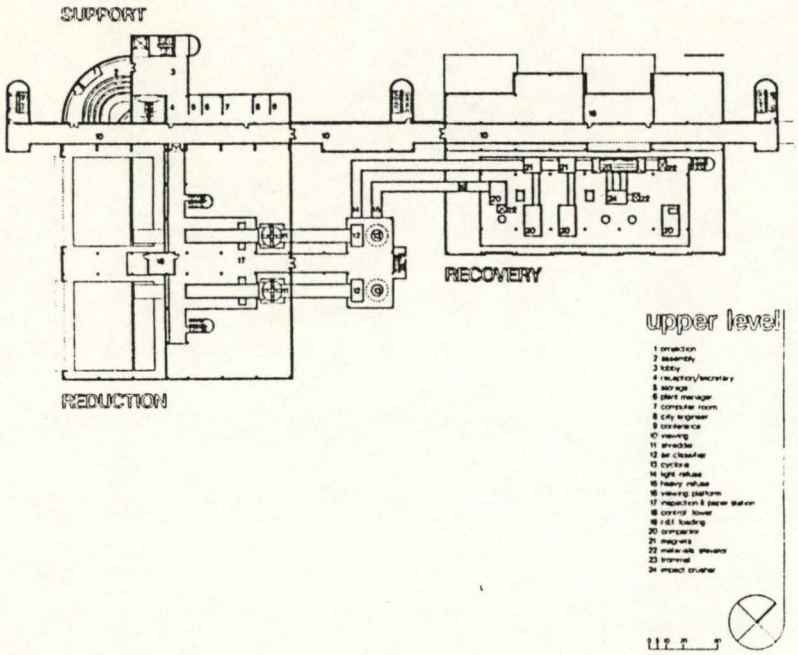
Service Zone

Space	Square footage		
	Phase 1	Phase 2	Phase 3
Wastewater treatment	900	900	900
Fuel storage	n/a	n/a	n/a
Maintenance area	1000	1000	1000
Parking[11]	10 cars	10 cars	10 cars

In the study of a complicated problem such as a Seafood Industrial Complex, it is helpful to research other projects of a similar nature so that one may learn from others' mistakes or more optimistically, realize the successes and attempt to reflect them in one's own project. The following section will study three projects, one of which is not a Seafood Industrial Park, but is an industrial facility with similarities to the Port Royal project. The other two case studies are existing Seafood Industrial Parks.

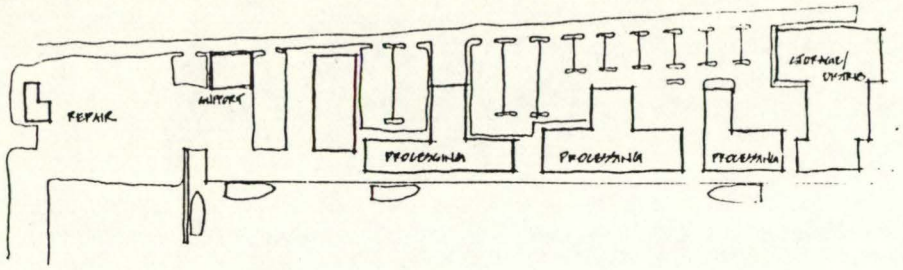
CASE STUDIES

Recovery New Orleans

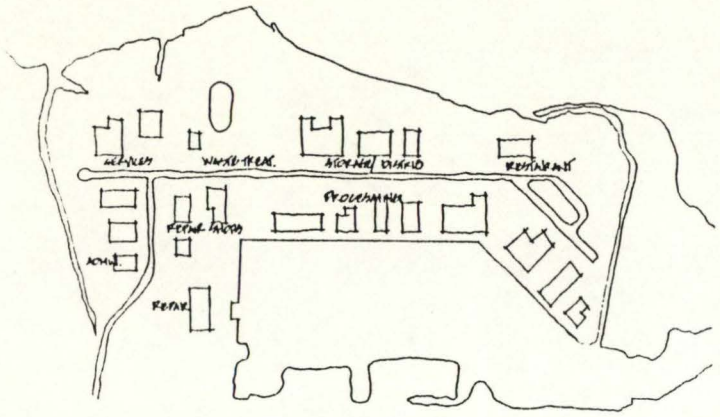


This project, submitted as a terminal project at Clemson University, is similar to the Seafood Industrial Complex because of the importance the process plays in the design, as well as the successful integration of the public into the facility. In addition, the use of the process as a concept determinant should be studied as appropriate for an industrial facility. The clear architectural delineation of process seems very appropriate for a facility which has so few other concept and form determinants.

Sea Harvest Industrial Park



SHIP is located in Cape May, New Jersey, and, unlike the proposed Port Royal Seafood Industrial Complex, it is privately rather than state owned. It utilizes a traditional market arrangement with a fragmented physical layout. It is easy to see the problems in transportation that this may bring about. One notices that this facility seems to have little architectural cohesiveness, rather it reads as a disjointed group of buildings in close proximity to each other. It is hoped that a greater sense of unity will be achieved in Port Royal Seafood Harbor.



Wanchese Seafood Industrial Park

This park is located on the Outer Banks of North Carolina at Wanchese. Like the previously described SHIP, it employs the traditional handling alternative. Unlike SHIP, it is owned and operated by an agency of the State of North Carolina. Unfortunately, due to a problem with the silting of Oregon Inlet, the complex's outlet to the Ocean, the facility has not proved as successful as originally hoped. It is assumed however, that once the inlet problem is solved, there will be no problem in leasing sites to processors and dealers, thereby making the facility successful. From an organizational standpoint this industrial park as with that at Cape May, lacks a cohesive sense of order.

This section deals with codes affecting the design of the project as well as standards for certain facilities.

CRITERIA

Codes

Port Royal Harbor will be designed under the quidelines of The Southern Standard Building Code. It is classified as Group G-Industrial and as such must meet the requirements set up for this category of building.

In addition, Floor levels must be at least 12 feet above mean sea level to meet flood plain regulations.

Environmental Protection Agency Requirements

It will be necessary to have storm water from specified areas treated for separation of oil and grease prior to its discharge. These areas include the repair and fueling portions of the site. In addition, current Environmental Protection Agency regulations require a spill prevention control and countermeasure plan be prepared and implemented for facilities which, due to their location, could reasonably be expected to discharge oil in harmful quantities into or upon the navigable waters of the United States or adjoining shorelines.[12]

Foundation

The site is a marsh area, which although no longer viable, is considered as such by the Army Corps of Engineers and the Environmental Protection Agency. Current standards discourage introducing fill into a marsh area. Since all floor levels will need to be at least 9 feet above the average land elevation of 3 feet, election of an appropriate foundation system for the buildings will be critical. It is felt that a foundation system of concrete piles should be used when designing the complex because of both structural and environmental reasons.

Types of Piles

There are two types of piles, end bearing and skin friction. End bearing piles are the most commonly used in the lower part of the state. It is usual to drive the pile to a depth of 80-100 feet until a suitable stable layer is reached. There are two methods of driving pile, displacement and replacement. Displacement is the most commonly used in this area.

WORKS CITED

[1]South Carolina State Ports Authority, *Seafood Industrial Park Port Royal, South Carolina, V. 1* p. 106.

[2]*Ibid.*, p. 110.

[3]*Ibid.*, p. 139.

[4]*Ibid.* p. 140.

[5]*Ibid.*, p. 130

[6]*Ibid.*, p. 12

[7]*Ibid.*, p. 7

[8]*Ibid.*, p. 11

[9]*Ibid.*, p. 11

[10]South Carolina State Ports Authority, *Seafood Industrial Park Port Royal, South Carolina, V. II*, pp. 21-24.

[11]*Ibid.*, pp. 39-50

[12]V. I, *op. cit.*, p. 138

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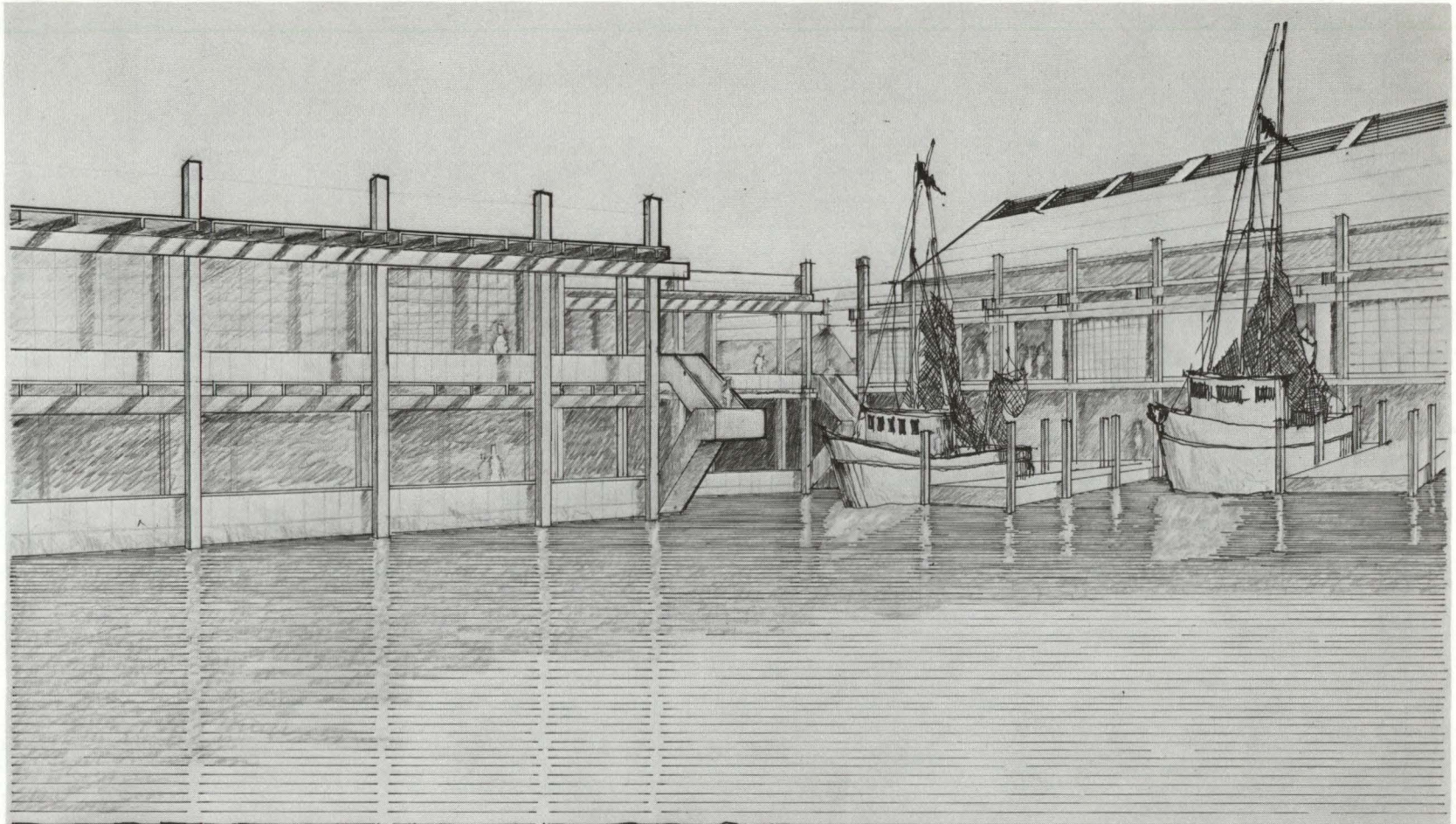
PROPOSAL

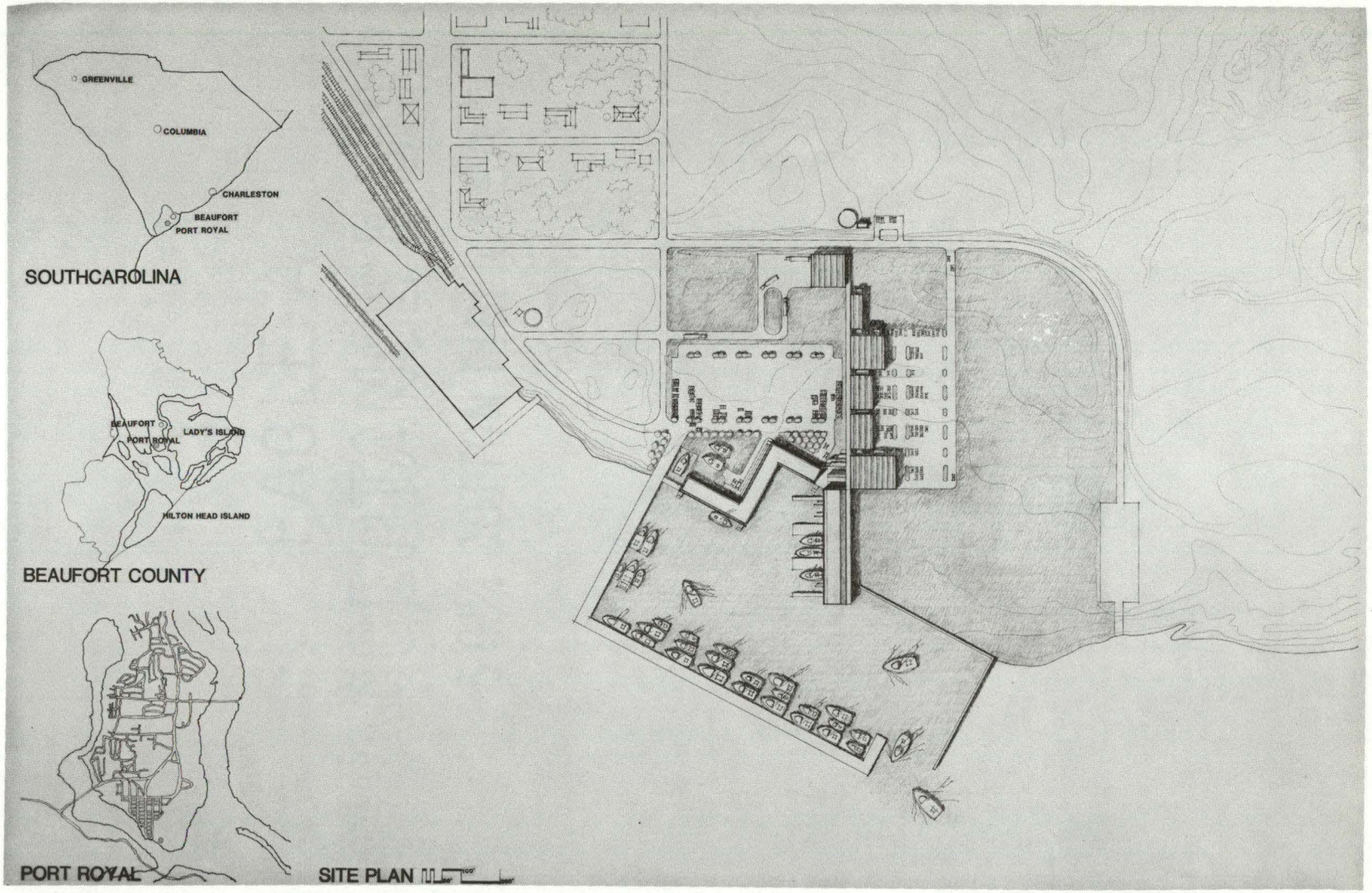


PORT ROYAL HARBOR

A SEAFOOD INDUSTRIAL COMPLEX

A TERMINAL PROJECT SUBMITTED TO THE FACULTY OF THE COLLEGE OF ARCHITECTURE, CLEMSON UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE, MASTER OF ARCHITECTURE.
19 APRIL 1983

John T. Clayton III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CHARLESTON
BEAUFORT
PORT ROYAL
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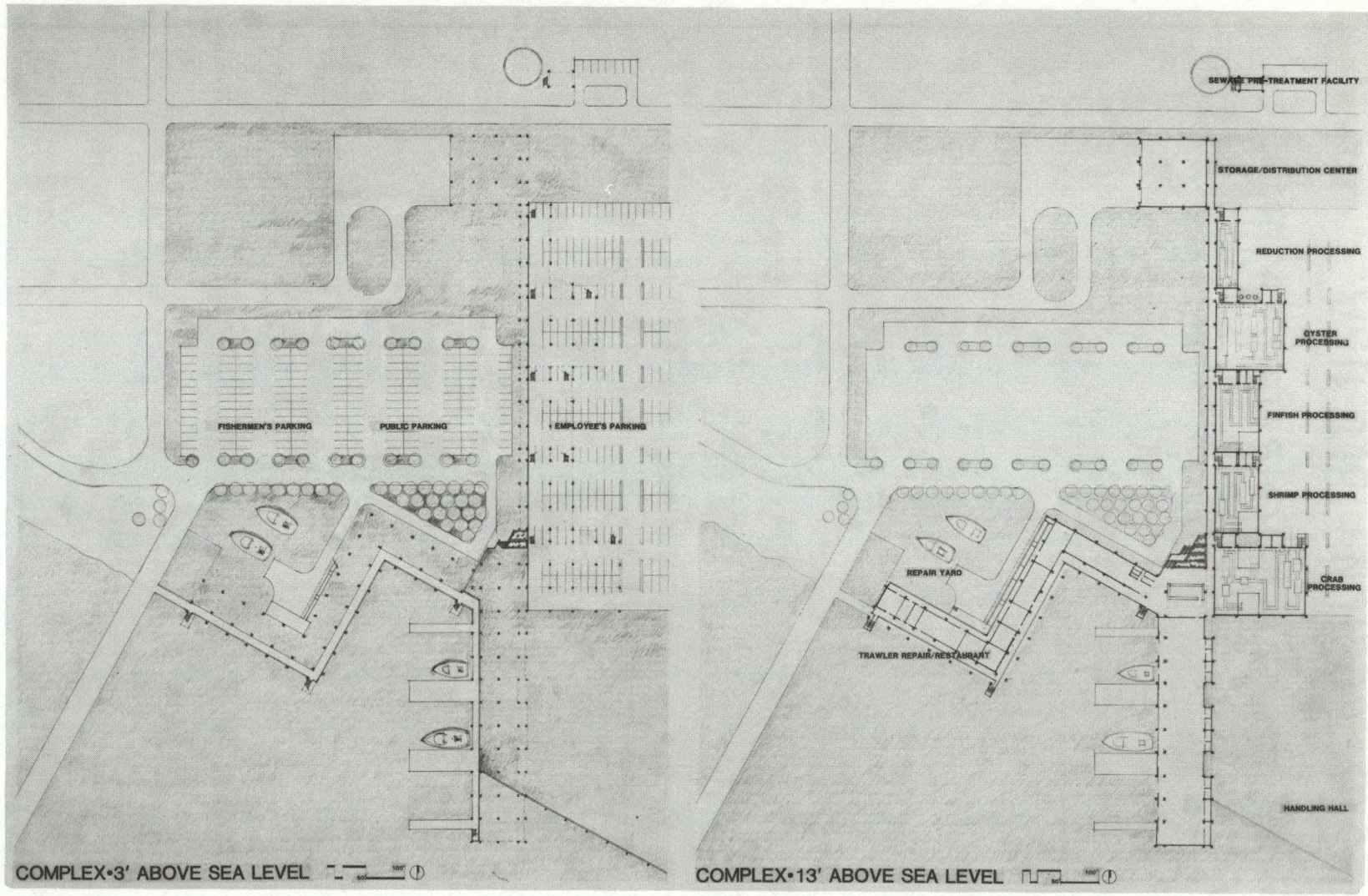
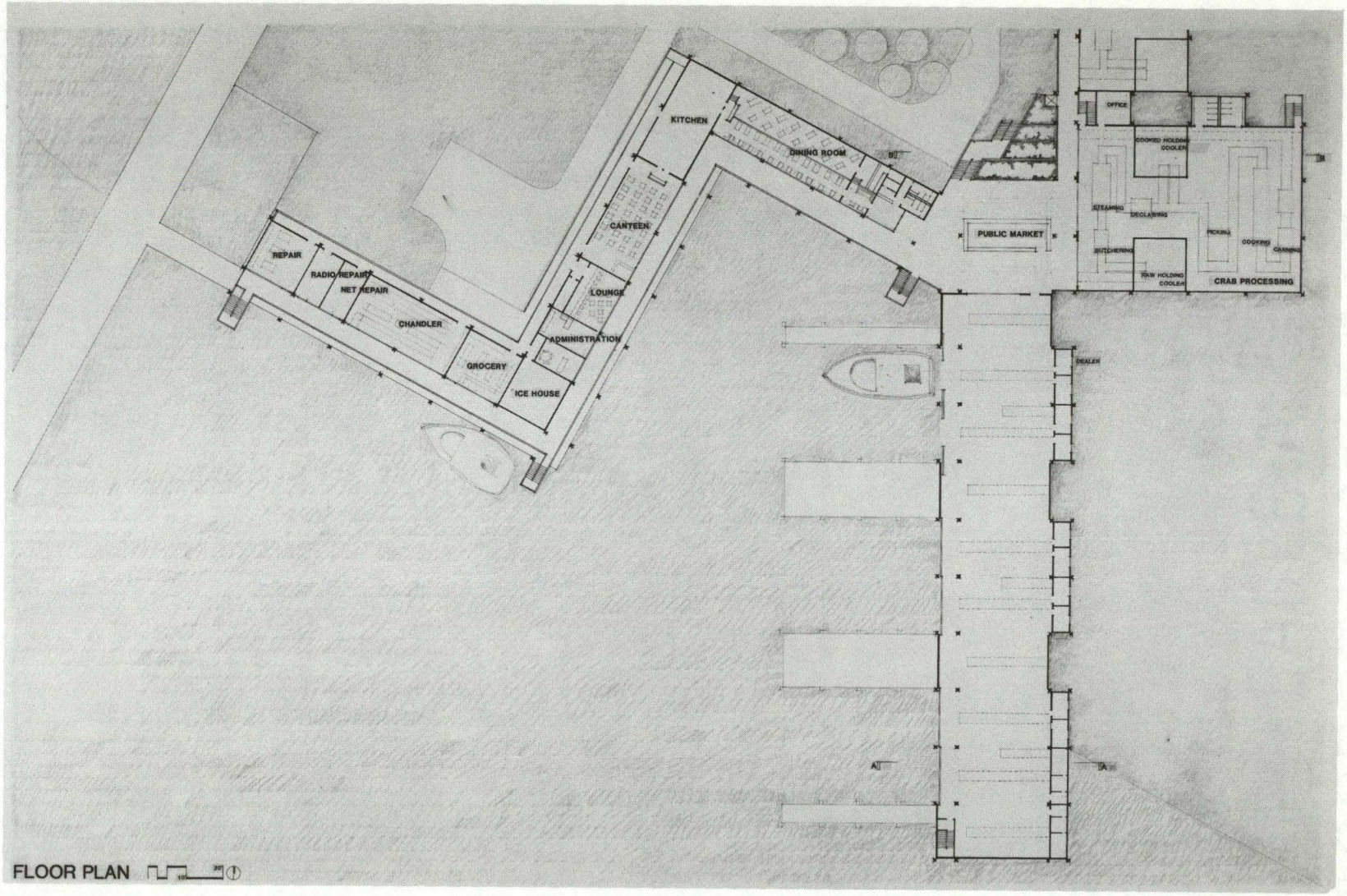
PORT ROYAL
LADY'S ISLAND
HILTON HEAD ISLAND
BEAUFORT COUNTY
PORT ROYAL
SITE PLAN


FISHERMEN'S PARKING
PUBLIC PARKING
EMPLOYEE'S PARKING
COMPLEX•3' ABOVE SEA LEVEL
SEWAGE PRE-TREATMENT FACILITY
STORAGE/DISTRIBUTION CENTER
REDUCTION PROCESSING
OYSTER PROCESSING
FINFISH PROCESSING
SHRIMP PROCESSING
CRAB PROCESSING
REPAIR YARD
TRAWLER REPAIR/RESTAURANT
HANDLING HALL
COMPLEX•13' ABOVE SEA LEVEL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OFFICE
COOKED HOLDING COOLER
STEAMING
DECLAWING
PICKING
COOKING
CANNING
BUTCHERING
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CRAB PROCESSING
PUBLIC MARKET
CANTEEN
REPAIR
RADIO REPAIR
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GROCERY
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DEALER
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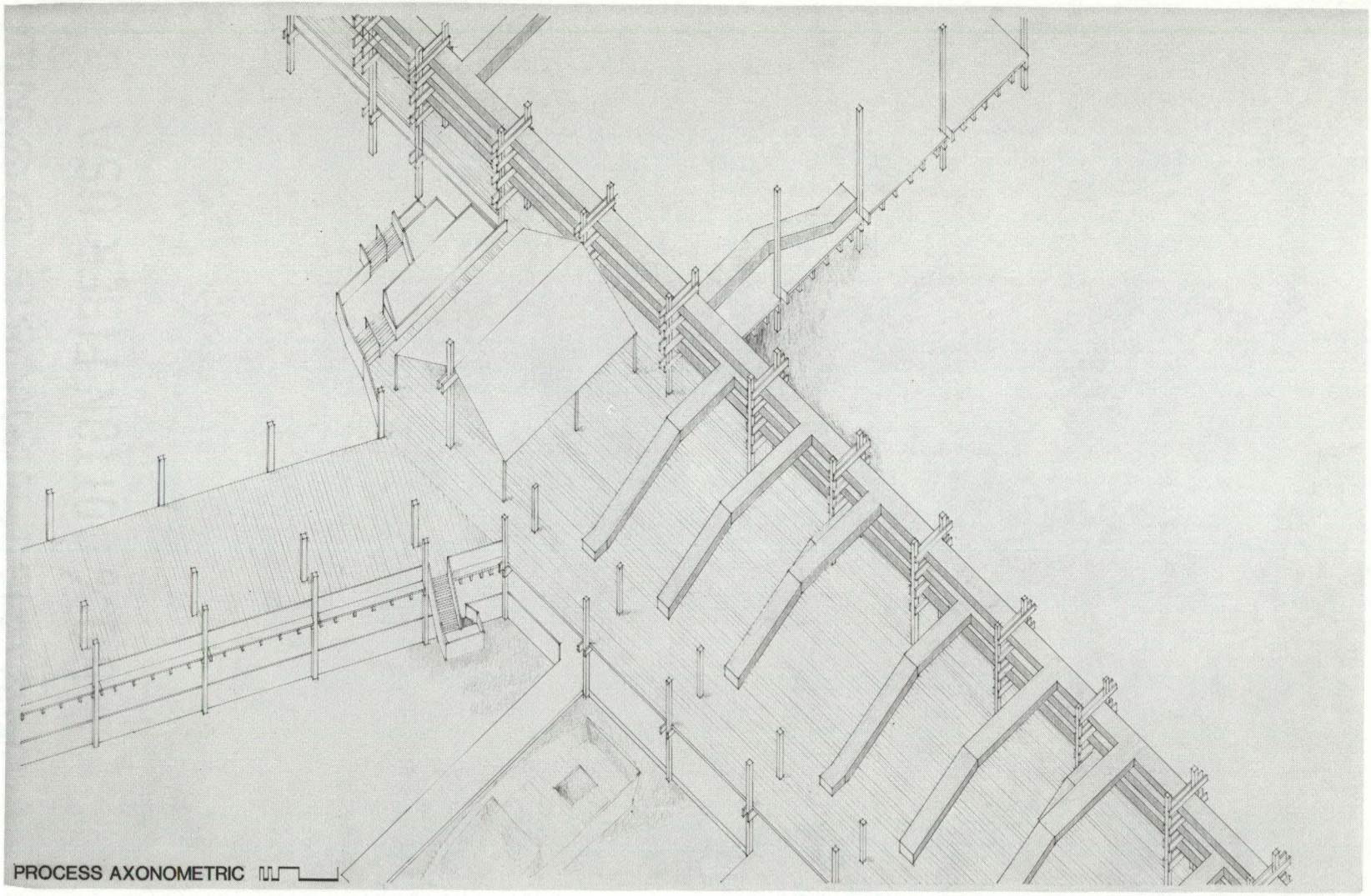
FLOOR PLAN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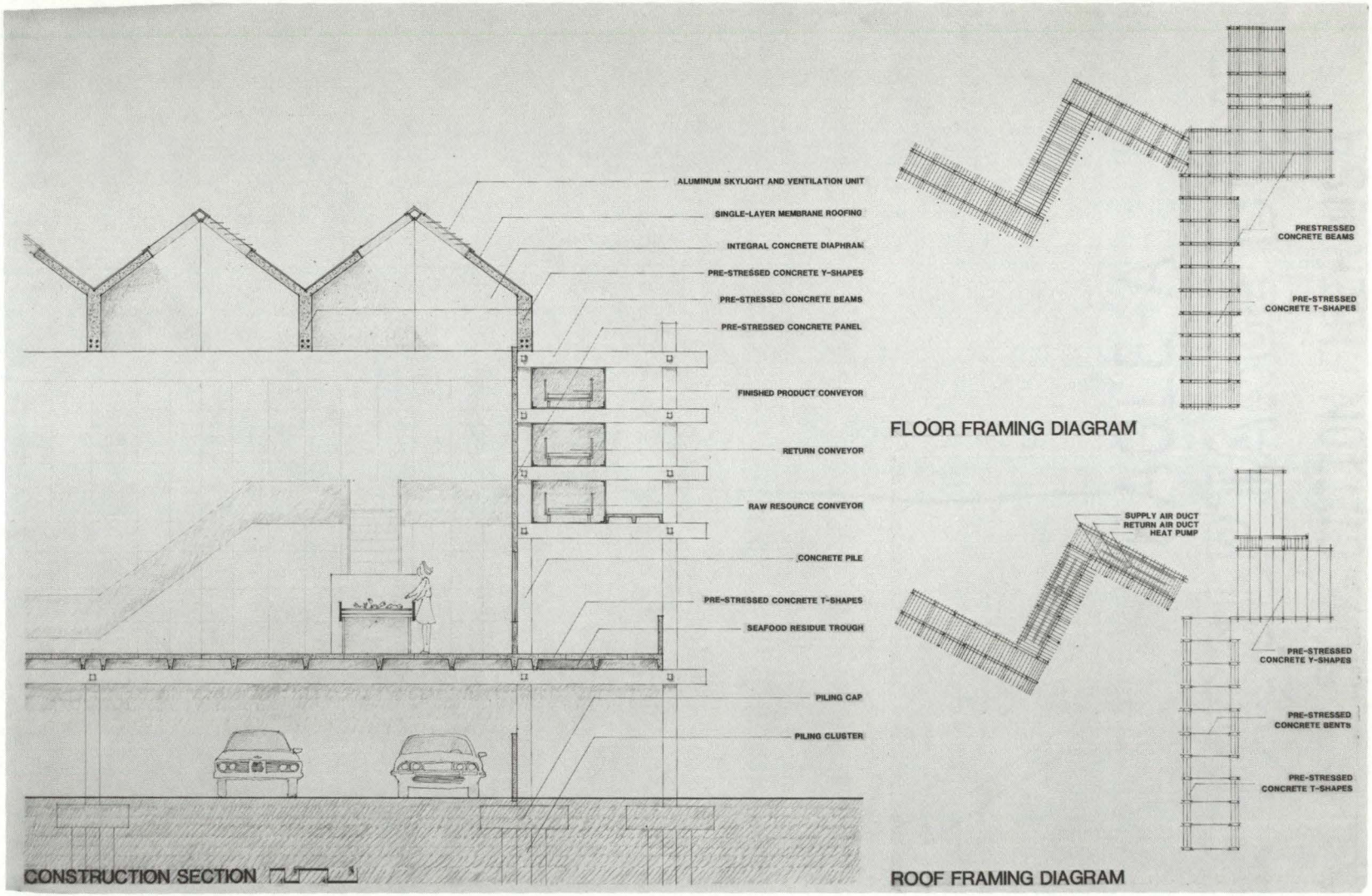
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SINGLE-LAYER MEMBRANE ROOFING
INTEGRAL CONCRETE DIAPHRAM
PRE-STRESSED CONCRETE Y-SHAPES
PRE-STRESSED CONCRETE BEAMS
PRE-STRESSED CONCRETE PANEL
FINISHED PRODUCT CONVEYOR
RETURN CONVEYOR
RAW RESOURCE CONVEYOR
CONCRETE PILE
PRE-STRESSED CONCRETE T-SHAPES
SEAFOOD RESIDUE TROUGH
PILING CAP
PILING CLUSTER
CONSTRUCTION SECTION
PRESTRESSED CONCRETE BEAMS
PRE-STRESSED CONCRETE T-SHAPES
FLOOR FRAMING DIAGRAM
SUPPLY AIR DUCT
RETURN AIR DUCT
HEAT PUMP
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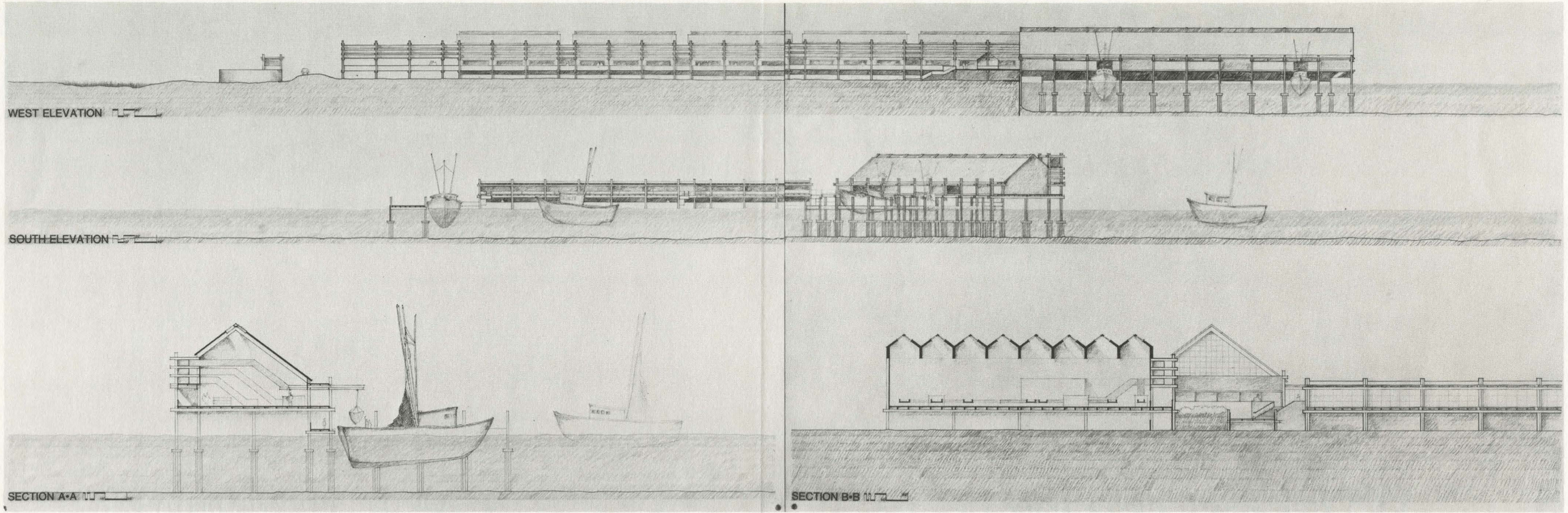
ROOF FRAMING DIAGRAM


WEST ELEVATION
SOUTH ELEVATION
SECTION A•A
SECTION B•B